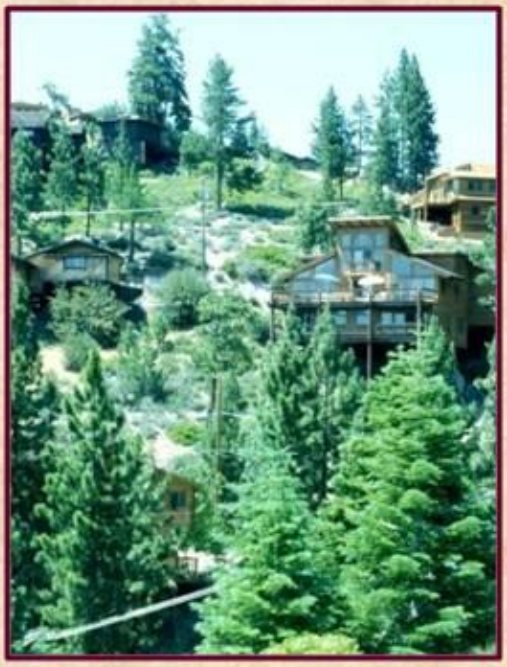
Idaho State Assessment of Forest Resources (SAFR)



Draft Issues, Discussion, Data, Methodologies, Issue Maps

July 14, 2009

Issue: Relative Threats to Forest Health

—Map (PDF) Relative Threats to Forest Health (DRAFT)

The intent of this issue is to:

- Identify areas where invasive plants threaten forest health
- Identify areas where damaging insects threaten forest health
- Identify areas where disease threatens forest health
- Identify areas where climate change may increase stress to forests

Discussion: Forests and tree canopy face many different kinds of threats. The purpose of this issue is to identify the most significant biological threats. These include forest insects and diseases that result in tree mortality, noxious (invasive) species which can compromise the health and composition of forest stands, and climate change, which may modify current ranges of forest species, adding additional stresses to forests. Not only do stresses to forests from these factors damage forests, they have an ecological, social and economic impact as well. They impact markets, recreation, wildlife habitat and can exacerbate uncharacteristic wildfire. The areas identified within this issue are where these problems currently exist or are likely to exist in the near future, and where management activities can minimize these threats. Other issues within the State Assessment of Forest Resources (SAFR) address areas where forests and tree canopy can help mitigate the causes of some of these threats.

Data Used:

Data used for this issue were divided into three main categories as follows:

1. **Forest Inspect Pests and Diseases,** comprised of:
    a. **Balsam Wooly Adelgid**, using joint USDA Forest Service and Idaho Department of Lands joint Balsam Wooly Adelgid (BWA) ground survey data, and **Hydrologic Unit code (HUC) 6th level** (watersheds) (http://inside.uidaho.edu/)

    BWA can be a serious pest of subalpine fir, especially in areas where this is the primary forest species providing shade for streams. Loss of canopy in these areas can impact water quality and fish populations downstream. Due to the slow spread of BWA and the relatively small size of infestations, how best to express this issue was challenging. An annual rate of spread was determined, but it was small enough that affected areas would not have any real impact on the forest health risk issue. Instead, we took the location of infestations (point data) from on-the-ground joint Forest Service/IDL BWA delimiting surveys (years 1990,1991,1997, 1998, 2006 and 2007), and identified the 166 watersheds (6th order Hydrologic Unit Codes) in which they fell. These watersheds were

converted to a 30 m raster grid and ***reclassified with a value of one if BWA is present, and zero if not***. This serves more as an indicator that BWA is something to be aware of in these watersheds, but the value is low as it does not indicate the actual size and extent of infestations.

b. **White Pine Blister Rust**
This layer was developed from 1) a potential vegetation layer and 2) a table delineating likelihood of Western White Pine. The U.S. Forest Service's Idaho Panhandle National Forest provided both datasets. The table was joined to the layer and the data reclassified into three classes. Per recommendation by Carol Randall, U.S. Forest Service Entomologist and Tom Eckberg, Idaho Department of Lands Forest Health Resource Specialist, ***excellent likelihood was assigned a value of five, good likelihood a value three, and poor or fair were assigned a value of zero***. The objective of the layer is to identify probable areas of concern for Blister Rust, which parallels western white pine habitat. This layer will also serve as a proxy for root disease concerns. Areas that have been affected by blister rust and no longer have white pine now support grand fir and Douglas-fir, which are the most susceptible to root disease.

c. **Mountain Pine Beetle**, using 1990 – 2008 Forest Service aerial survey data (http://www.fs.fed.us/r1-r4/spf/fhp/aerial/gisdata.html) and selecting out Mountain Pine Beetle (MPB) on lodgepole pine

The polygons of MPB mortality on lodgepole pine for the years 1990 through 2008 were examined to see if direction and distances could be detected from one year to the next. While direction proved elusive, a mean spread distance of 2,314 meters was calculated. The polygons of MPB mortality for the above years were merged and dissolved into mortality centers, and buffered four times using the mean spread distance as the buffer. Then, the first buffer ring and the base polygon were removed as these comprise areas where the MPB has killed the suitable trees or where damage is likely done, but not yet visible. The resulting layer was converted to 30 m raster grid cells and reclassified. The data was further refined by applying a mask so that only areas of predicted infestation in lodgepole pine are shown. Since the areas represent probability of infestation, the closer they are to the original infestation, the greater the likelihood of infestation. ***The three remaining buffered rings around each polygon were given values of five, four and three as they radiated outward from the infestation.***

d. **Tussock moths** were identified as the most serious insect and disease threats to forest health on state and private forestlands. The most critical areas were identified using 1990 – 2008 Forest Service aerial survey data and historical refinements. (http://www.fs.fed.us/r1-r4/spf/fhp/aerial/gisdata.html)

Tussock moth populations tend to be cyclic, building to significant levels in predictable locations every 8-12 years. Currently, we are in a population growth phase, and expect increased damage over the coming years. This Tussock Moth layer was developed by identifying the 6th level Hydrologic Unit Code (HUC) watersheds with tussock moth presence from aerial detection surveys and then rating them based on severity suggested by an entomologist team consisting of Carl Jorgensen (USFS), Tom Eckberg (IDL), and Carol Randall (USFS). Watersheds were converted to a 30 m raster grid and reclassified with one (low threat), three (moderate threat), and five (high threat)

2. **Terrestrial noxious weeds,** consisting of:
    a. Idaho State Department of Agriculture (ISDA) listed **terrestrial noxious weeds** from March 2009 (http://inside.uidaho.edu/)
    b. **Weed presence** in Idaho from the Bureau of Land Management (BLM) consolidated dataset from December 2005 (http://inside.uidaho.edu/)

       Includes data from the BLM Boise, Twin Falls, Idaho Falls and Coeur d'Alene Districts and the Idaho Department of Agriculture

    c. **Hydrologic Unit code (HUC) 6th level** (watersheds)

Process: The 2009 ISDA layer was combined with the 2005 BLM consolidated dataset to develop statewide coverage of noxious weeds in Idaho. All plants and weeds not listed on Idaho states 57 noxious weed list were removed from the list. A list of the 57 noxious weeds is located at: (http://www.idahoag.us/Categories/PlantsInsects/NoxiousWeeds/watchlist.php). This new dataset was converted into a 30 m resolution raster grid. Percent coverage of the noxious weeds within each 6th Level HUC were obtained taking the total count of noxious weed pixels, converting these pixels into area and dividing by total area of HUC. Percent coverage was then reclassified using natural breaks into 3 classes, with values from zero to three.

3. **Climate change,** consisting of:
    a. **Current range (2000) and predicted habitat range in 2030 for Ponderosa Pine**
    b. **Current range (2000) and predicted habitat range in 2030 for Lodgepole Pine**
    c. **Current range (2000) and predicted habitat range in 2030 for Douglas Fir**

The three keystone indicator species were selected for this sub-issue by a subset of the Core Development Team working specifically on the Forest Health Risk issue. Climate shift data used for these three species was developed by Gerald Rehfeldt et al. Processes and assumption used in the modeling are described in the paper "Empirical Analysis of Plant-Climate Relationships for the Western United States" published in the International Journal of Plant Science, Volume 167(6) pages 1123-1150, in 2006.

Process: We used current range of these three species and compared it with the predicted habitat range in 2030. For each species, where the habitat was the same in 2000 and 2030 a value of zero was given. Where the habitat changed from 2000 to 2030 a value of one was given. Habitat changes included both areas where the habitat moved into a new area that it did not occupy earlier and areas where the habitat would no longer occur. These areas represent potential areas of additional stress, but also identify areas where consideration of climate change impacts may help inform species selection when replanting is planned.

The habitat change values for the three tree species were added together giving a climate change layer with values of zero – three. A value of zero indicates areas where the current and predicted habitat ranges for the three species did not change. A value of one indicates areas where one of the three species had a change in habitat, two indicates areas where two species had a change in habitat, and three indicates areas where three species had a change in habitat.

Final Issue Process: To develop the map for this issue, each of the above layers were added together and classified into five groups through natural breaks, where a score of five identifies areas of greatest threat. The highest potential scores for each cell are:

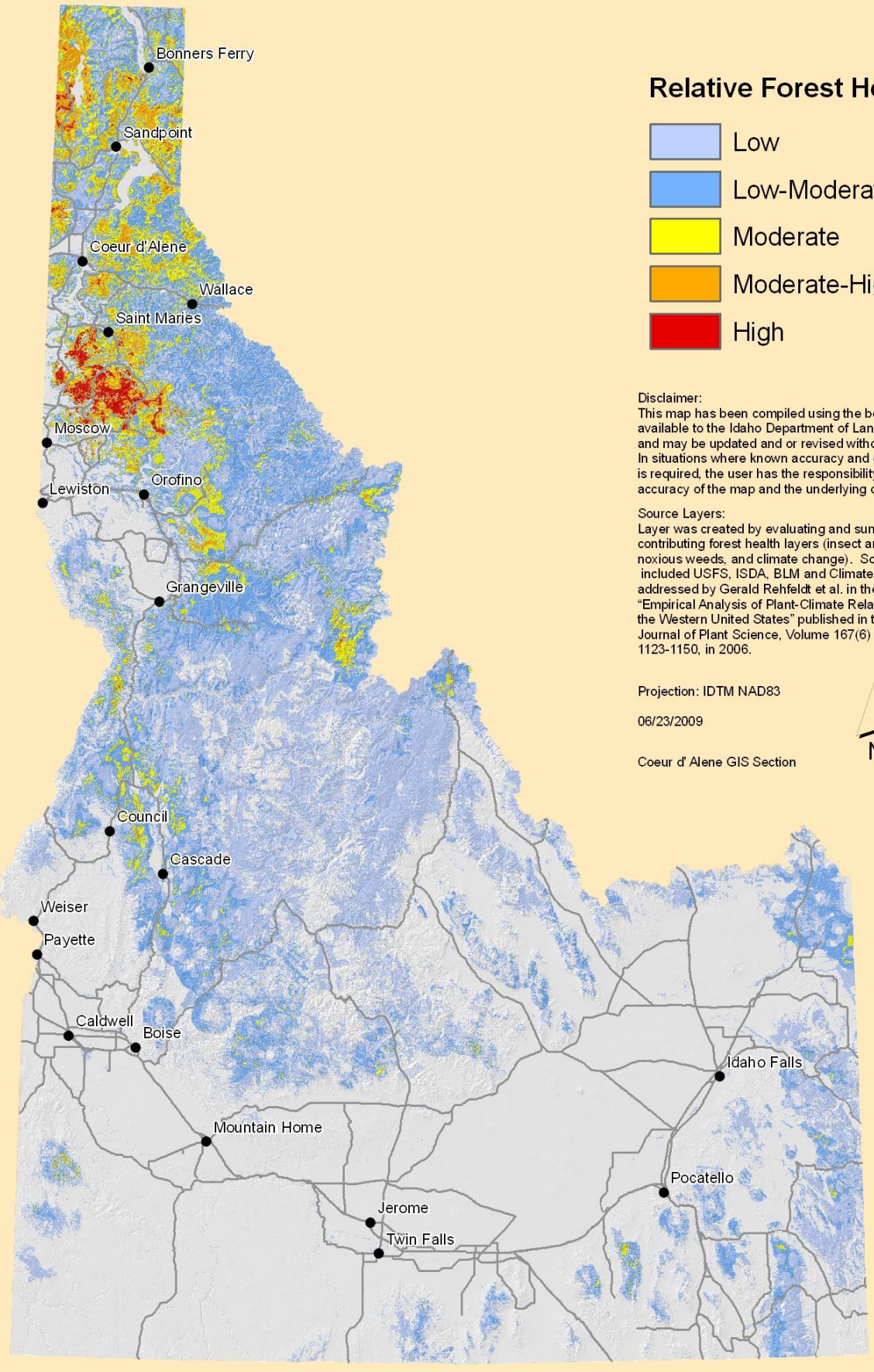
Balsam Wooly Adelgid .....1 points
White Pine Blister Rust / Root rot.....5 points
Mountain Pine Beetle .....5 points
Tussock Moth.....5 points
Noxious weed presence.....3 points
Climate change.....3 points
TOTAL POSSIBLE ..... 22 points

Data Considered, but not used:

The Core Development Team considered forest fragmentation within this issue, as forests fragmented by roads, developments or other land cover changes could increase spread of noxious weeks and, potentially, insects. The National Forest Fragmentation dataset recommended by the USDA Forest Service on their State Assessment website is at a scale of 1km raster grid, which is roughly 1,000 times more coarse than the 30 m resolution of this assessment. For this reason, these data were not used. The team also considered road density as a different way to measure fragmentation, but this was not felt to be a significant driver for this issue. It was also felt that development and recreation pressure informed addressed fragmentation within that issue.

The team also considered using the National Forest Insect and Disease Risk Map but, like the fragmentation dataset, it was at a 1km resolution, far too coarse for this assessment.

Relative Threats to Forest Health in Idaho



Relative Forest Health Risks

- Low
- Low-Moderate
- Moderate
- Moderate-High
- High

Disclaimer:
This map has been compiled using the best information available to the Idaho Department of Lands at the time and may be updated and or revised without notice. In situations where known accuracy and completeness is required, the user has the responsibility to verify the accuracy of the map and the underlying data sources.

Source Layers:
Layer was created by evaluating and summing several contributing forest health layers (insect and disease, noxious weeds, and climate change). Sources for layers included USFS, ISDA, BLM and Climate change as addressed by Gerald Rehfeldt et al. in the paper "Empirical Analysis of Plant-Climate Relationships for the Western United States" published in the International Journal of Plant Science, Volume 167(6) pages 1123-1150, in 2006.

Projection: IDTM NAD83

06/23/2009

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Issue: Wildfire Impacts

This issue characterize where communities and their associated forestlands are at greatest risk from uncharacteristic wildfires.

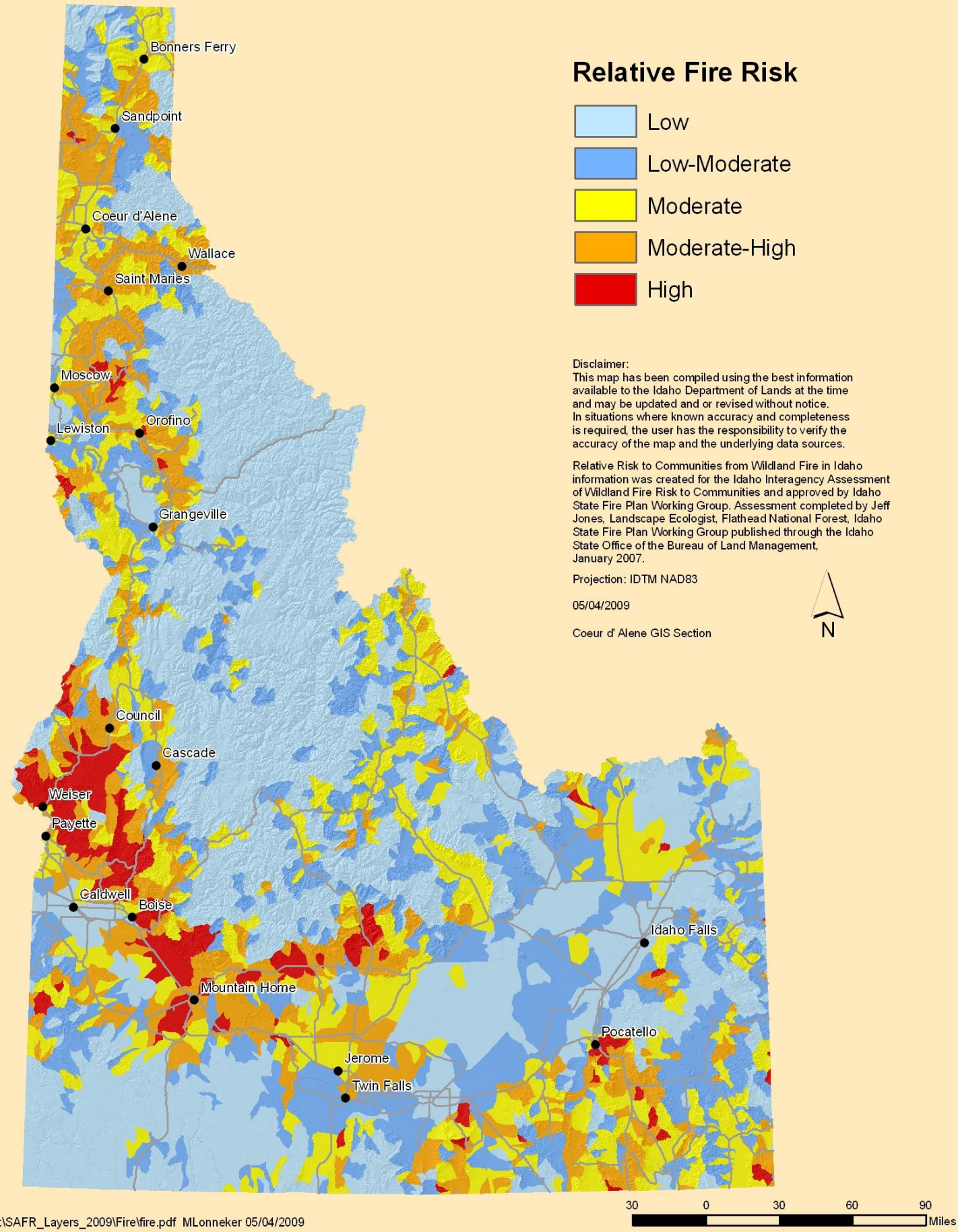
Layer Selected: Relative Risk to Communities from Wildland Fire

After significant discussion and review of various datasets, the Idaho SAFR Core Team decided to use the ***Relative Risk to Communities from Wildland Fire in Idaho*** model, developed by the Idaho Interagency Wildland Fire Working Group. A complete description of this model is available for download at: http://www.idahofireplan.org/images/Assessment.pdf. The assessment was completed by Jeff Jones, Landscape Ecologist, Flathead National Forest. This model considers relative wildland fire risk (weather, ignition probability, rate of spread), relative wildland fire hazard (fuel hazard, expected fuel moisture, slope effect on fire spread) and wildland urban interface (inhabited areas, communities at risk). The SAFR Core Development Team felt this model best informed this issue and is supported by the Interagency Fire Plan Working Group.

A number of datasets were initially considered for this issue. These include:

1) Wildland Urban Interface (WUI) County-generated: This dataset includes areas defined at the local level through collaborative efforts. The process through which each county went through in identifying their WUI is not necessarily the same, and this dataset may over or under emphasize areas from county to county depending on their process. While very useful at the local level, the Core Development Team decided not to use this dataset because the process was not consistent across the state, and making relative assumptions statewide may provide misleading results.
2) Wildland Urban Interface (WUI) per the Idaho Interagency Assessment of Wildland Fire Risk to Communities: This dataset identifies wildland urban communities from the Federal Register (66 Fed. Reg. 753, January 4, 2001), and inhabited areas from the 2000 Census. These areas were buffered by a distance of one mile to identify the wildland urban interface areas. This is already included within the model chosen for use.
3) Fire Regime Condition Classes (FRCC): This dataset shows changes in fuels from historical conditions and helps characterize forestlands at higher risk of uncharacteristic wildland fire. However, its resolution is coarse and "it was developed for the western United States and was not intended to be mapped or summarized at a finer level (e.g., mapped or summarized for a single state), which could provide misleading results." Information on this dataset can be found at: http://www.fs.fed.us/rm/pubs_other/rmrs_2004_menakis001.pdf.

Relative Risk to Communities from Wildland Fire in Idaho



Issue: Potential Loss of Canopy to Development, Urbanization and Recreation

—Map (PDF) Potential Canopy Loss from Development, Urbanization and Recreation (DRAFT)

The intent of this issue is to:

1. Identify the areas at greatest risk of conversion from forestland to other uses—specifically development. Often, forested areas are highly desirable for home sites or new subdivisions. With this conversion comes a loss of productive forests, increased wildfire risk to property as more homes are "in the woods", and pressure to reduce or eliminate management on adjacent lands. Also important are those areas that may be converted from one housing density to a significantly higher density within developed areas as this may also lead to loss of canopy and the benefits it provides.
2. Identify those areas were pressure from off road vehicle (ORV) use in undesignated areas can lead to degradation of forested areas. Such use has increased erosion, user conflicts, spread of invasive species, damage to cultural sites, disturbance to wildlife, destruction of wildlife habitat, and risks to public safety. Along with fire and fuels, invasive species and loss of open space, this issue is one of the US Forest Service's "four threats." Managing the areas where impact or potential impact is greatest, in addition to educational efforts will help alleviate these impacts.

Originally, Canopy Loss due to Urbanization and Development; and Recreation Pressure were separate issues. IDL Staff made the decision to combine them as they are both impacted by population density, and because we were only measuring ORV pressure within the Recreation dataset. It was felt that to separate them would be placing too great an emphasis on population density by counting it twice.

Data used:

Development Potential

—Map (PDF) Development Risk based on Estimated Changes in Housing Density within Idaho (DRAFT)

The National Guidance suggested using the "Forests on the Edge" data developed by Dr. David Theobold, Colorado State University. These data use the SERGoM v3 model, described in the research paper **Watersheds at Risk to Increased Impervious Surface Cover in the Conterminous United States,** to predict housing density in ten-year increments from 2000 to 2030. By subtracting 2000 housing densities from 2030 predicted housing densities, we can express the potential areas of new development.

The Theobold data broke out housing density into ten classes; we modified these to eight classes as follows:

1. No Development or >80 acres per unit (rural)
2. 40-80 acres per unit (rural 1)
3. 20-40 acres per unit (rural 1)
4. 10-20 acres per unit (rural 2)
5. 1.7-10 acres per unit (rural 2)
6. 0.6-1.7 acres per unit (exurban/urban)
7. <0.6 acres per unit (exurban/urban)
8. Urban/built up (commercial, industrial, transportation)

When considering the movement from one density class to another, we wanted to make some judgment about the relative impact of that change. IDL Staff developed the following matrix showing values from 0 (no change) and 1 (low impact change) to 5 (highest impact change) and classified the data accordingly. The numbers in the colored boxes represent the housing density classes shown above. So, movement from density class 2 (one unit per 40 – 80 acres) in 2000 to density class 5 (1.7 – 10 units per acre) by 2030 is considered a very high impact (value of five), A movement from density class 2 (one unit per 40 – 80 acres) in 2000 to density class 4 (one unit per 10 – 20) acres in 2030, on the other hand, is considered low-moderate change.

		2030							
		No Dev	Rural			Urban			
2000		1	2	3	4	5	6	7	8
No Dev	1	0	1	1	3	5	5	5	5
Rural	2	--	0	0	2	5	5	5	5
	3	--	--	0	0	5	5	5	5
	4	--	--	--	0	3	4	5	5
Urban	5	--	--	--	--	0	2	4	5
	6	--	--	--	--	--	0	4	5
	7	--	--	--	--	--	--	0	3
	8	--	--	--	--	--	--	--	0

0 or -- = no or negative change
1 = low impact change
2 = low-moderate impact change
3 = moderate impact change
4 = high-moderate impact change
5 = high impact change

Recreation Pressure from ORV's

—Map (PDF) Off Highway Recreation Pressure in Idaho (DRAFT)

We used a model developed by the Idaho Department of Lands that incorporated US Census data for population density, the number of ORV registrations by county, TIGER 2000-based streets dataset, and travel distance preferences from 2002 Recreation Demand Assessment by the Idaho Department of Parks and Recreation.

We used the following assumptions in developing the model:

- Census population can be used as a surrogate for overall recreation pressure
- OHV registration totals by county can be used to estimate motorized recreation pressure
- The public road network is how recreation pressure is transmitted and dispersed to forested lands
- Recreation pressure comes primarily from urban population centers within and outside the state:
    1. Boise/Nampa/Caldwell
    2. Twin Falls
    3. Pocatello
    4. Ogden/Layton, UT
    5. Logan, UT
    6. Idaho Falls
    7. Moscow, ID/Pullman, WA
    8. Clarkston, WA/Lewiston, ID
    9. Spokane, WA/Coeur d'Alene, ID
- Recreation pressure on a forestland can come from multiple population centers and is additive
- Recreation pressure decreases as travel time to a recreation destination increases (actually, not an assumption but confirmed by IDPR recreation demand surveys)
- All parts of the state are equally desirable recreation destinations and certain destinations (such as resort areas, parks, etc.) do not attract more recreation pressure than others
- Recreation activity is defined as that which lasts a day or less; multi-day recreation activities are not considered

The result is a map that shows ORV pressure based on a 1 to 3 hour travel time. Those areas closest to urban areas (requiring less time to get to) were scored highest. Data was divided into three classes, scored 1 through 3. More information on this model can be found by reading the **Modeling Recreation Pressure on Idaho Forest Lands**.

Data considered, but not used:

Development Potential

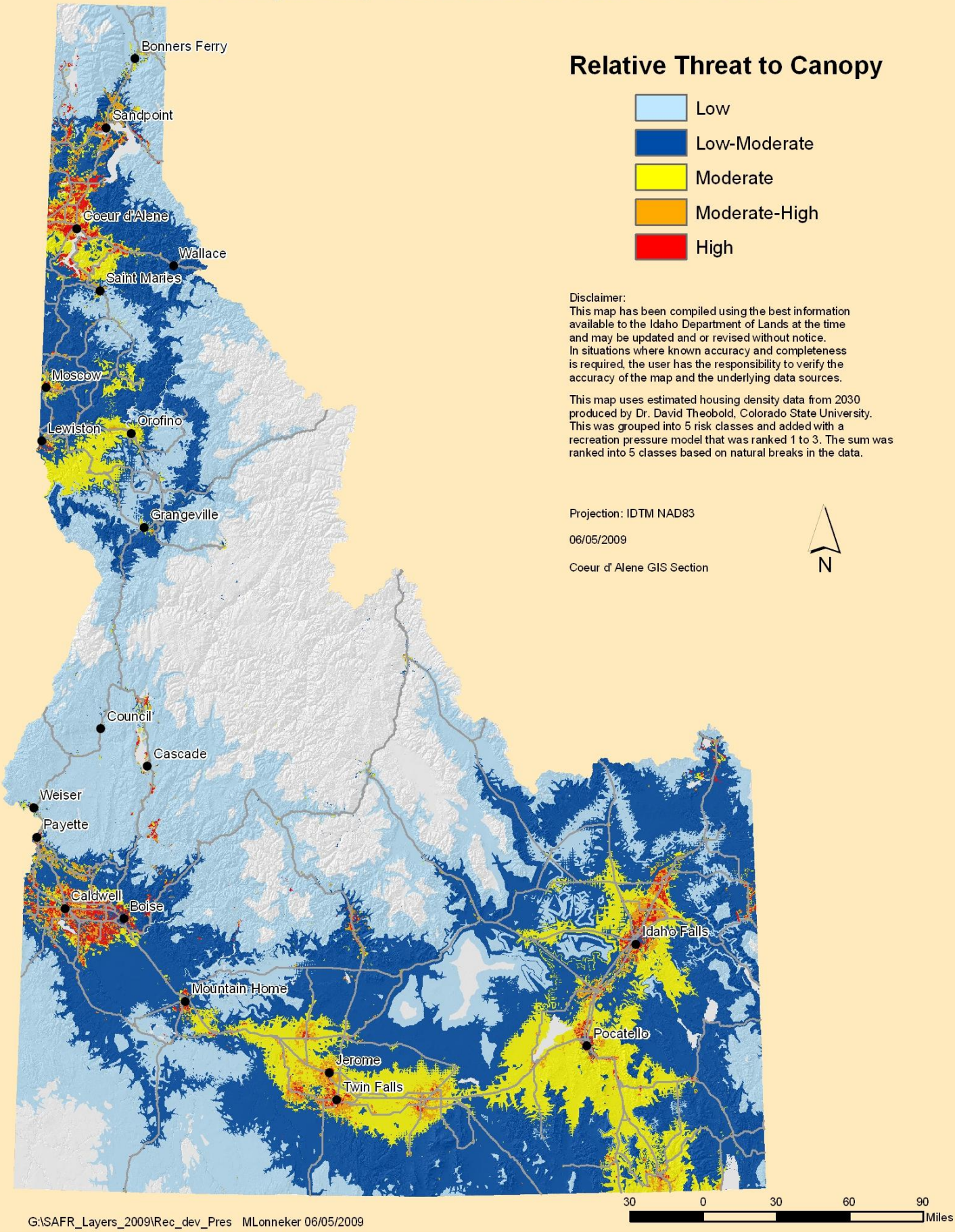
The Core Development Team also suggested using the industrial forestlands owned by Real Estate Investment Trusts (REITs) and Timber Investment Management Organization (TIMOs), since the potential divestiture of these lands for development is increasing. Upon further investigation, IDL GIS staff determined these datasets were unavailable, and were therefore not used.

Recreation Pressure

One of the datasets considered early on was the High-Use Dispersed Recreation Areas, from the Interior Columbia Basin Ecosystem Management Project, a model that incorporated several other datasets. This was ultimately not used due to currency of data and the feeling that what the model we had available to us was better.

We also wanted to incorporate data from Idaho Parks and Recreation, and this is part of the model we are using. Additionally, we contacted the Idaho Conservation League and the Wilderness Society, but they did not have data the type of geospatial data we needed.

Potential Loss of Forests and Canopy from Development, Urbanization and Recreation



Issue: Relative Potential Benefit to Wildlife and Biodiversity

—Map (PDF) Relative Potential Benefit to Wildlife & Biodiversity (DRAFT)

The intent of this issue is to:

- Identify the areas of greatest conservation value for wildlife habitat and plant and animal biodiversity, and where management can enhance these values.

Discussion: Initially, this issue was listed as two separate ones – 'Wildlife Benefit' and 'Healthy Forest Ecosystems.' After conversations with representatives of Idaho Fish and Game (IDFG) and The Nature Conservancy (TNC), a decision was made to combine these into a Wildlife and Biodiversity issue. Principle reasons for this are that data for priority conservation areas, developed by the TNC, and Special Status Species data (including threatened and endangered) included plant communities and species as well wildlife. Breaking these apart would have the effect of overweighting fish and wildlife.

This issue will highlight those areas were forests play a key role in wildlife critical habitat and range, threatened, endangered and rare fish and wildlife habitat and plant communities. Within the context of the full assessment and response strategy, projects proposed within areas of overall high priority—which include areas identified as high priority for this issue—should consider activities that will enhance the habitat of the plant, fish and wildlife species listed within those areas.

Data used:

Multiple data layers informed this issue. These are:

1. **Fish Distribution,** comprised of:
    a. **Bull Trout Fish Distribution**
    b. **Cutthroat Trout distribution**
    c. **Chinook Salmon distribution**
    d. **Steelhead Salmon distribution**
    e. **Sockeye Salmon distribution**

    All fish distribution data came from Streamnet (http://www.streamnet.org/mapping_apps.html). The data represent current distribution and activity for the above species. More information on creation of this feature class is available at http://www.streamnet.org/about.html. Distribution data for each species was buffered by 75 feet on any critical habitat stream, river, or lake. These

buffered layers were then converted into a 30 m raster grid and re-classed to either a 1 (presence) or 0 (absence). The final fish distribution map was derived by adding up the five sub layers and reclassifying ***0 through 5*** based on the number of separate species represented in each pixel.

2. **Comprehensive Wildlife Conservation Strategy (CWCS) Focal Areas and Big Game**
    a. Focal Areas from the Idaho CWCS (http://fishandgame.idaho.gov/ifwis/ifwisweb/IDCWCS/FA/)

    Through the workshop process, Idaho conservation partners mapped and attributed focal areas across Idaho. These are general areas known to be important for the species of greatest conservation need identified in the Idaho Comprehensive Wildlife Conservation Strategy, but by no means are intended to imply that conservation actions should be restricted to these areas. Focal areas were defined as resource-based, management-based, or both:

    Resource Focal Area:
    A geographical area necessary for the long-term persistence of SGCN and their habitats (in other planning efforts these may be referred to as High Resource Value Areas or Biologically Important Areas).

    Management Focal Area:
    A general geographical area that targets resources and efforts where they can benefit the largest number of species and habitats in need of conservation. Management focal areas are generally larger and may include species and/or habitats other than SGCN as well as non-biological factors.

    Focal areas were classified by their type, converted to 30m raster, and reclassified as: ***0 where none exist, 1 where it is a resource Focal Area, and 3 if it is a Management Focal Area***.

    b. **Big Game Habitat** from Idaho Fish and Game, including:
        i. **Mule Deer** –Summer and Winter Range, and other Important Habitat
        ii. **Elk** – Critical Summer and Winter Range
        iii. **Mountain Goat** – Habitat
        iv. **Bighorn Sheep** – Priority Habitat

    Species were selected, and data provided by the Idaho Fish and Game Department. These species represent the most critical big game species per the CWCS. Each species habitat/range was converted to 30m raster and classified as **1 where the species exists, and 0 where it doesn't**.

The scores from both a) and b) above were added together. Pixels could have a score from 0 to 7. These were reclassified by natural breaks into five classes, 0 through 5.

3. **The Nature Conservancy Ecoregional Conservation and Priority Conservation Areas**, comprised of:

    a. **Canadian Rocky Mountains Ecoregional Assessment Data – Priority Conservation Areas**. This data is access restricted. Information on the assessment, including report, maps and data can be accessed at: (http://www.waconservation.org/ecoCanadianRockies.shtml)

    b. **Columbia Plateau Ecoregional Assessment Data – Priority Conservation Areas**. This data is access restricted. Information on the assessment, including the report, maps and data can be accessed at: (http://www.waconservation.org/ecoColumbiaPlateau.shtml)

    c. **Middle Rockies – Blue Mountains Ecoregional Assessment Data – Conservation Areas**. The assessment report and data can be accessed at: (http://www.waconservation.org/ecoBlueMountains.shtml)

    d. **Utah – Wyoming Rocky Mountains Ecoregional Assessment Data – Conservation Areas**. The assessment report can be accessed at: (http://conserveonline.org/coldocs/2003/10/uwrm_plan_ver2001.pdf)

    The metadata for Conservation Area datasets describes them as:

    "These data describe the priority areas for conserving imperiled species and functioning ecosystems. These extraordinary places are all part of a common "ecoregion", sharing similar climate, geologic historic, landforms, and native species. Resources for conservation in these ecoregions are limited, urban areas are expanding, and an extraordinary heritage of native species and ecosystems is at risk. This assessment is intended to help conservation agencies, planners, and organizations direct their resources to the most important places for conservation. It describes a "portfolio" of priority conservation areas which are 1) of exceptional biological value and 2) the most likely places for conservation to succeed based on their current condition, land use, and other factors. Most importantly, this portfolio captures as much of the biodiversity of the ecoregion as possible, ensuring that each local site contributes to an ecoregion-wide strategy for conservation."

    While all identified conservation areas are considered priority, these area within the first two datasets (a. and b.) were further refined to include those which are most important and/or at highest risk.

Because datasets c. and d. did not further prioritize conservation areas, there may be more identified conservation areas relative to the other two. For this reason, all areas were combined, converted to a 30m raster grid. Pixels were classified with a value of ***3 if they were a conservation or high conservation area per the datasets used, and 0 if they did not.***

4. **Federally Listed Threatened and Endangered Species,** from the Idaho Conservation Data Center, Idaho Department of Fish and Game—from 2007.

   The occurrences represent Federally Listed Threatened and Endangered in Idaho. This spatial coverage and the occurrences contained in it are not a public record. Data were converted to 30m raster pixels, and classified with a ***1 if a T&E species exists, and 0 if not***. These species are listed at the end of this document.

Final Relative Benefit to Wildlife and Biodiversity map: The four layers listed above were added together and reclassified by natural breaks into five classes indicating low to high relative benefit to Wildlife and Biodiversity.

Data Considered but not Used:

Early on, when Healthy Forest Ecosystems was being considered as a separate issue, the Core Development Team looked at using the Legacy Areas of Need and Fire Regime Condition Class to inform this issue. It was determined that the **Legacy Areas of Need** (AON) stood on its own as a separate assessment, and included many of the data being used in the SAFR. Rather than double count these data, the Legacy will be incorporated into the assessment as supporting information, and will be part of the Response Strategy. The SAFR, or components thereof, may be used as a secondary sort tool to further refine priority areas for potential Legacy Conservation Easements.

Fire Regime Condition Class represents areas depending on how well they are within or depart from historic fire regimes. The team felt that areas within historic fire regimes were those that were likely to be resilient to wildfire, and relatively intact. However, the disclaimer in this analysis states “Fire Regime Condition Classes were developed for the western United States and were not intended to be mapped or summarized at a finer level (e.g., mapped or summarized for a single state), which could provide misleading results.” For this reason, we felt using this in our statewide assessment would be an inappropriate and potentially inaccurate use of the data.

Species listed in Idaho based on published population data

Notes:

- This report shows the species listed in this state according to the Federal Register listing description.
- This list does not include experimental populations and similarity of appearance listings.
- This list includes species or populations under the sole jurisdiction of the National Marine Fisheries Service.
- Click on the highlighted scientific names below to view a Species Profile for each listing.

Listed species (based on published population data) -- 22 listings

Animals -- 18 listings

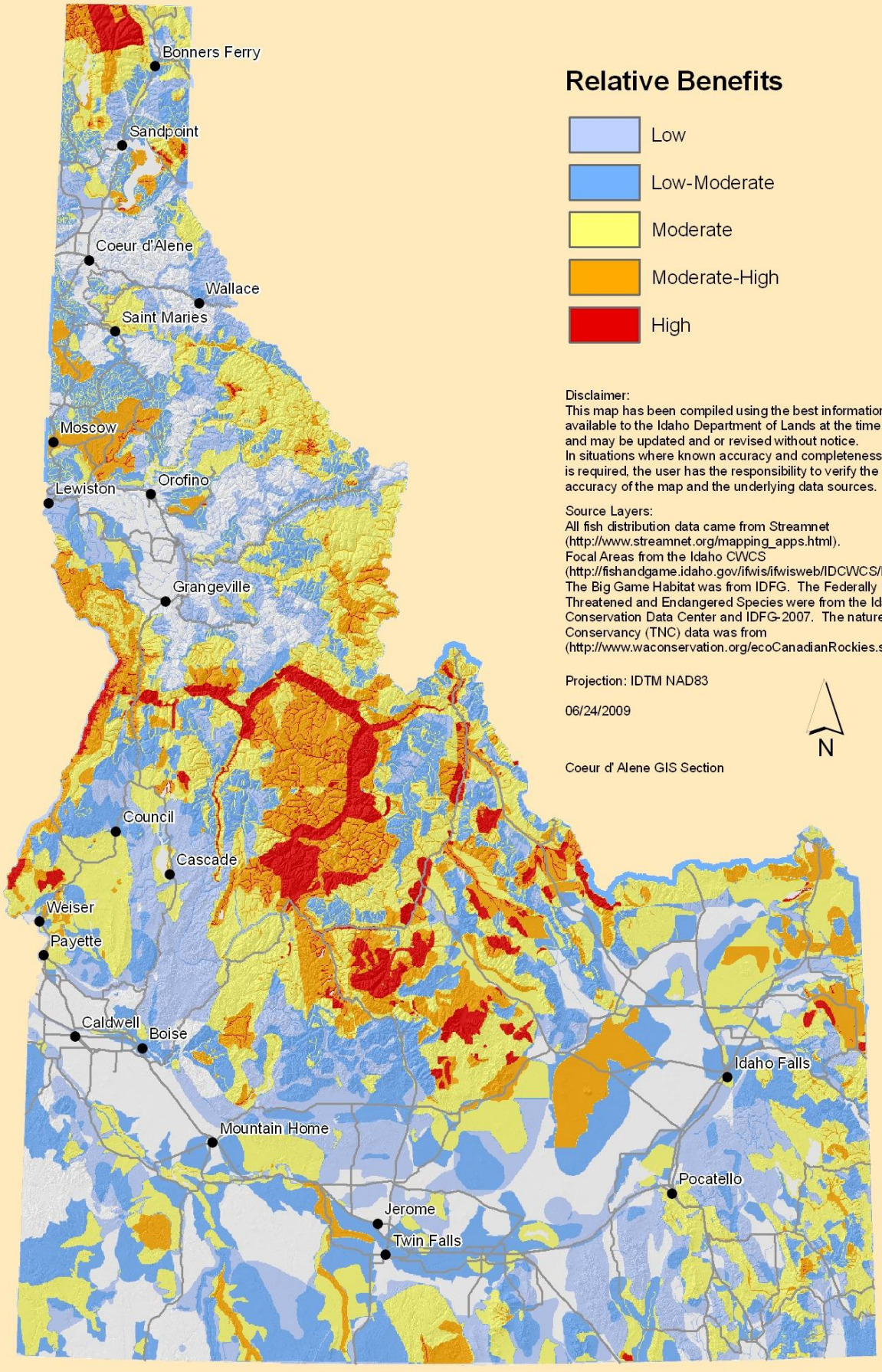
Status	Species/Listing Name
T	Bear, grizzly lower 48 States, except where listed as an experimental population or delisted (*Ursus arctos horribilis*)
E	Caribou, woodland Selkirk Mountain population (*Rangifer tarandus caribou*)
E	Curlew, Eskimo (*Numenius borealis*)
E	Limpet, Banbury Springs (*Lanx sp.*)
T	Lynx, Canada lower 48 States DPS (*Lynx canadensis*)
E	Rabbit, pygmy Columbia Basin DPS (*Brachylagus idahoensis*)
T	Salmon, chinook fall Snake R. (*Oncorhynchus (=Salmo) tshawytscha*)
T	Salmon, chinook spring/summer Snake R. (*Oncorhynchus (=Salmo) tshawytscha*)
E	Salmon, sockeye U.S.A. (Snake River, ID stock wherever found.) (*Oncorhynchus (=Salmo) nerka*)
T	Snail, Bliss Rapids (*Taylorconcha serpenticola*)
E	Snail, Snake River physa (*Physa natricina*)
E	Snail, Utah valvata (*Valvata utahensis*)
E	Springsnail, Bruneau Hot (*Pyrgulopsis bruneauensis*)
T	Squirrel, northern Idaho ground (*Spermophilus brunneus brunneus*)
T	Steelhead Snake R. Basin (*Oncorhynchus (=Salmo) mykiss*)
E	Sturgeon, white U.S.A. (ID, MT), Canada (B.C.), Kootenai R. system (*Acipenser transmontanus*)
T	Trout, bull U.S.A., conterminous, lower 48 states (*Salvelinus confluentus*)
E	Wolf, gray Lower 48 States, except where delisted and where EXPN. Mexico. (*Canis lupus*)

Plants -- 4 listings

Status	Species/Listing Name
T	Catchfly, Spalding's (*Silene spaldingii*)
T	Four-o'clock, MacFarlane's (*Mirabilis macfarlanei*)
T	Howellia, water (*Howellia aquatilis*)
T	Ladies'-tresses, Ute (*Spiranthes diluvialis*)

Last updated: June 19, 2009

Relative Potential Benefit to Biodiversity and Wildlife



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Issue: Relative Potential Benefit to Water Quality from Forests and Canopy

—Map (PDF) Relative Potential Benefit to Water Quality from Forests and Canopy (DRAFT)

The intent of this issue is to:

- Identify the areas of greatest need with respect to water quality and quantity, and where forests can have the greatest benefit.

Discussion: Rural forests and urban tree canopy have a tremendous value toward good water quality, aquifer recharge, stormwater mitigation and erosion control. Water is, in fact, one of the biggest issues in the west and is important for fish, wildlife and humans (agriculture, horticulture, industry and for drinking water). Forest canopy shades and cools streams—important for healthy fish habitat. Leaves of trees intercept rainfall, lowering the impact of rain on soil. Roots systems help break up compacted ground while stabilizing soil, leading to greater groundwater recharge, reduced stormwater runoff and associated contaminant loads, and less erosion.

This issue focuses forest management efforts in the areas in greatest need for improved water quality/quantity—in both rural and urban environments.

Data used:

Three data layers informed this issue. These are:

5. **Public Drinking Water**, comprised of:
    a. Source water delineations from Idaho Department of Environmental Quality's Source Water Protection program. (Note that these data are used with permission and not available for public release)
    b. Spokane Valley-Rathdrum Prairie (SVRP) Aquifer boundary for the Idaho portion of the aquifer from Idaho Department of Water Resources. Obtained from http://inside.uidaho.edu.

The Source Water dataset delineation process "establishes the physical area around a well or surface water intake that will become the focal point of a source water assessment. The process includes mapping the boundaries of the zone of contribution (e.g., the surface and subsurface areas contributing water to the well, or surface water intake) into time of travel zones (e.g., zones indicating the number of years necessary for a particle of water to reach a well or surface water intake). The size and shape of the source water assessment area depend on the delineation method used, local hydrogeology, and volume of water pumped from the well or surface water intake." (IDEQ 1999) Additional information on Idaho's Source Water

Assessment Plan and Drinking Water Protection Program can be found at http://www.deq.state.id.us/water/prog_issues/source_water/protection.cfm.

The boundary of the SVRP aquifer was added to the source water delineation to develop a public drinking water layer. This aquifer was added because it is both a sole source for drinking water for more than 500,000 people AND because it has no bedrock cap overlying it. Due to the latter attribute, it is the only designated Sensitive Resource aquifer in Idaho. This means it receives the highest level of protection, as activities over the aquifer can have a direct and relatively quick impact on water quality within the aquifer. Subwatersheds (Hydrologic Unit Code—or HUC—6th level) were flagged if a part of the aquifer or an area of source water delineation was within them. If the watershed was flagged it was classified with a value of 5. If not, it received a value of 0 indicating it does not contain either a part of the aquifer or an area of source water delineation.

6. Priority Watersheds

Priority watersheds are those containing an impaired stream or lake. Subwatersheds that contain an impaired lake or stream are classified with a value of 5. Subwatersheds that did not contain an impaired stream or lake are classified with a value of 0.

Source data is the 303(d) list of all impaired waters in the state, per Section 303(d) of the Clean Water Act. These data are collected and maintained by the Idaho Department of Environmental Quality, and are available for download on-line at:
http://data.insideidaho.org/data/IDEQ/archive/strm303d98_id_ideq.tgz
http://data.insideidaho.org/data/IDEQ/archive/lake303d98_id_ideq.tgz

7. Impervious Surfaces

Impervious surfaces came from the National Land Cover Database (NLCD) 2001 imperviousness layer, produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium, a partnership of federal agencies (www.mrlc.gov). For a detailed definition and discussion on MRLC and the NLCD 2001 products, refer to http://www.mrlc.gov/mrlc2k.asp.

The NLCD_2001_impervious layer was classified on the percent imperviousness value by natural breaks into 5 classes and weighted as follows:

Class	% Impervious	Value
0	0 - 6	0
1	7-17	0
2	18-30	1
3	31-46	1
4	47-65	1
5	66-100	1

Final Water Quality map: The resulting water quality layer was given a weight of 3 if it was either a priority watershed or a public drinking water watershed. A weight of 4 was given if a watershed was both a priority watershed and a public drinking water watershed. The impervious layer added 1 to the weighting where the impervious was greater than 18% (determined by looking at the natural breaks in the data). This gave the final water quality weighting values of 0, 3, 4, or 5.

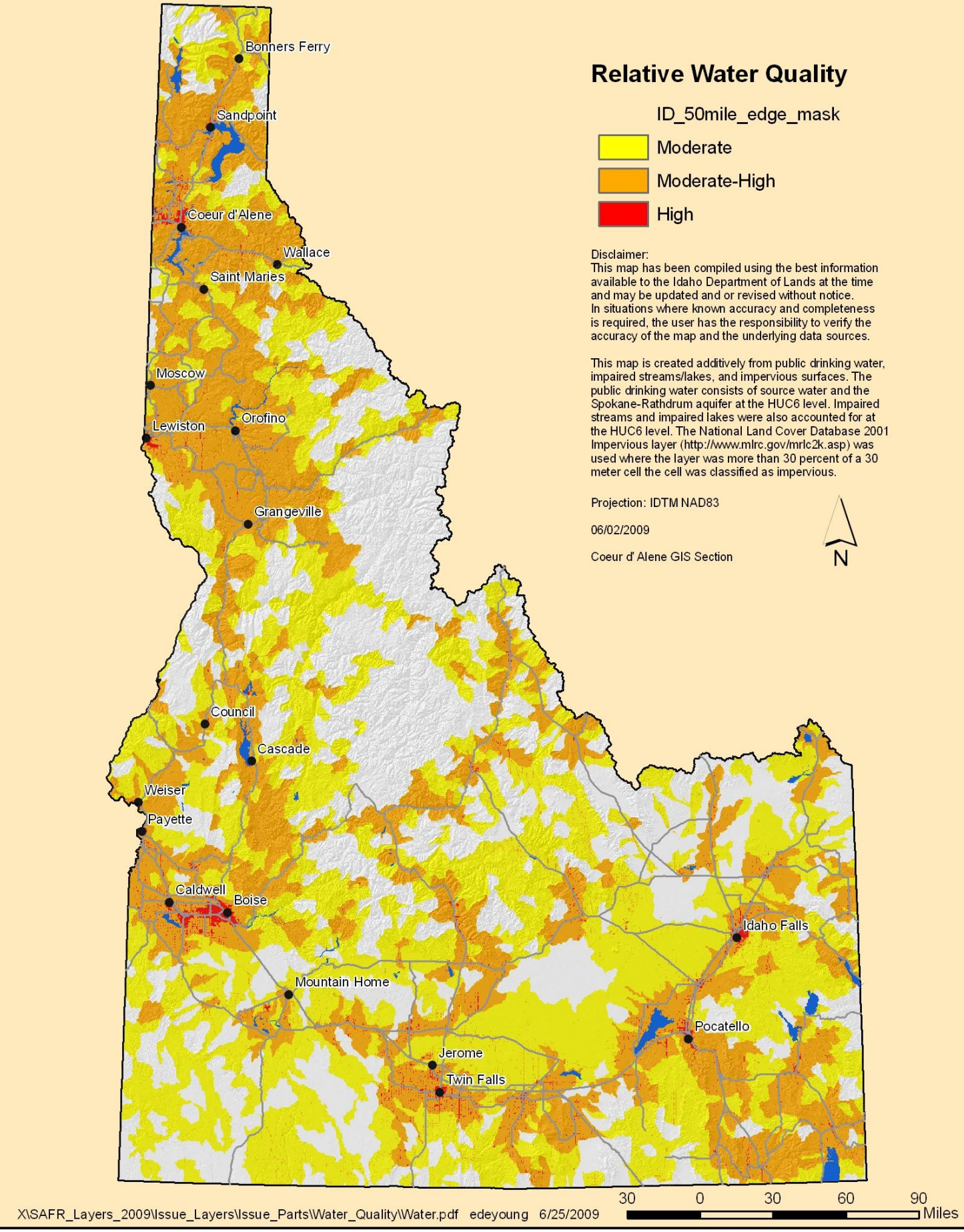
Data Considered, but not used:

The following datasets were also considered, but not used:

- Water temperature: temperature data is one of the attributes that may contribute to a lake or stream being classified as 303(d), so is already included.
- Well Locations/permits and the areas they draw from: There are more than 170,000 well permits within Idaho—most are for single dwellings, but other uses include industry, commercial, irrigation (agriculture), fire protection, heating, public water supply and more. The core team was uncertain how best to utilize this information to inform the water quality/quantity issue, especially since well data is point information (no draw areas were available) and so many existed. We felt the most critical water use for which forestry practices can have a significant impact is municipal/public drinking water. The core team decided using municipal water source data, which includes both below and above ground water sources via the Source Water Assessment Program, would better inform this issue.
- Major deep-water aquifers: Including these aquifers would result in a lot of area. There are three aquifers in Idaho designated as sole sources for drinking water—Rathdrum Prairie, Lewiston Basin and Eastern Snake River Basin aquifers. We considered including these, but two of the three have a bedrock cap (activities over the aquifer do not necessarily directly impact water quality or quantity within the aquifers unless pumping from or injecting into them). Areas over these aquifers from which municipal or public water supplies are drawn are already included within the source water data. As noted above, the Rathdrum Prairie Aquifer was included due to its designation as a Sensitive Resource aquifer, which affords it the highest level of protection. For this reason, this aquifer was included while the others were not.

IDEQ (Idaho Division of Environmental Quality) Ground Water Program, Idaho Source Water Assessment Plan, 1999, Boise, ID 200 p.
http://www.deq.state.id.us/water/data_reports/source_water/swa_plan_1999.pdf

Relative Potential Benefit to Water Quality and Quantity in Idaho



Issue: Relative Potential Benefit to Air Quality from Forests and Canopy

—Map (PDF) Relative Potential Benefit to Air Quality from Forests and Canopy (DRAFT)

The intent of this issue is to:

- Identify are the areas of greatest need with respect to air quality and where forests can have the greatest benefit.

Discussion: Air quality is both impacted by and benefited from forests. Wildfires—especially large uncharacteristic ones—pump a great deal of particulates (from smoke) and carbon into the air. Communities within the air sheds of these fires suffer poorer air quality and commensurate health impacts. Certain tree species are also net producers of biogenic volatile organic compounds (BVOC's), which can exacerbate ozone production, especially in urban areas. However, forest canopy can also absorb and filter particulates and pollutants out of the air, improving air quality. Likewise, trees sequester carbon and release oxygen—important for mitigating climate change and for human and animal health. Since temperature is a catalyst for production of volatile organic compounds (VOC's), the cooling effect of tree canopy in urban areas can lower their production. Sources of VOC's include any petroleum product that breaks down (asphalt, plastics, etc.) and parked vehicles (evaporation of fuel in gas tanks). By also cooling buildings and thereby lowering energy use, urban tree canopy can also reduce energy production. If this energy is from fossil fuels, this results in additional emissions reductions, including carbon.

It makes good sense to manage forests within urban air sheds to increase forest health and fire resiliency, thereby reducing negative impacts on public health. Likewise, increasing canopy cover and forest management within these areas also has a positive public health impact by helping reduce the causes of pollution while filtering out other pollutants and particulates.

Data used:

There were three principle datasets used in this analysis.

1. **Non-attainment zones**.

   Non-attainment areas were obtained from the Idaho Department of Environmental Quality. These are areas within Idaho where air pollution levels persistently exceed the national ambient air quality standards (NAAQS), designated "nonattainment." EPA considers any geographic area that meets or has pollutant levels below the NAAQS an attainment area. Under ideal circumstances, all of Idaho would be classified as "attainment." Areas with persistent high pollutant levels are designated as nonattainment areas, meaning these areas have violated federal health-based standards

for outdoor air pollution. Each nonattainment area is declared for a specific pollutant, meaning the same area could be "attainment" for one pollutant, but "nonattainment" for a different pollutant. Nonattainment areas for different pollutants may overlap each other or share common boundaries.

This layer was used to select all subwatersheds (Hydrologic Unit Code—or HUC—6th level) that contained non-attainment areas. Subwatersheds that contained a non-attainment area were given a value of 5 and Subwatersheds that did not contain a non-attainment area were given a value of 0.

2. **Smoke impact zones**
   These data were provided by the Idaho/Montana Airshed Group http://www.smokemu.org/index.php. Air Impact Zones are areas where smoke from wildfires is likely to be a problem because of local topography, meteorology, and areas with existing air quality problems that smoke from wildfires will exacerbate, or other factors. Increasing canopy in these areas will help mitigate the impacts of particulates from smoke, improving air quality and public health.

3. **Canopy cover relative to impervious surfaces**
   Data used were two products of the National Land Cover Dataset (NLCD) 2001—Impervious surfaces and Tree Canopy. These data were produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium, a partnership of federal agencies (see www.mrlc.gov). For a detailed definition and discussion on MRLC and the NLCD 2001 products, refer to http://www.mrlc.gov/mrlc2k.asp.

   As noted in the issue discussion above, impervious surfaces have a negative impact on air quality for a variety of reasons. Research has demonstrated the significant positive impact of tree cover in such areas by filtering particulates, absorbing CO2 and other pollutants, and lowering ambient air temperature while reducing the impact of ultraviolet radiation. With these data, we are identifying areas that have a high percentage of impervious surfaces, but lack significant canopy cover in the surrounding area. Indentified, then, are areas where additional canopy can have a substantial impact in mitigating poorer air quality to which impervious surfaces contribute.

The NLCD_2001_impervious layer was classified on the percent imperviousness value by natural breaks into 5 classes and weighted as follows:

Class	% Impervious	Weight
0	0 – 6	0
1	7 – 17	1
2	18 – 30	2
3	31 – 46	3
4	47 – 65	4
5	66 – 100	5

The NLCD_2001_canopy layer was classified on the percent canopy cover value. A neighborhood mean canopy cover was created from the canopy cover data by taking the mean value of the 25 (5 by 5) neighboring cells for every cell. The mean canopy cover value is a measure of the canopy cover surrounding impervious areas. The mean canopy cover was grouped by natural breaks into 5 classes and weighted as follows:

Class	Mean % Canopy	Weight
1	0 – 17.431	0
2	17.432 – 38.349	1
3	38.50 – 59.267	1
4	59.268 – 78.690	2
5	78.691 – 100	3

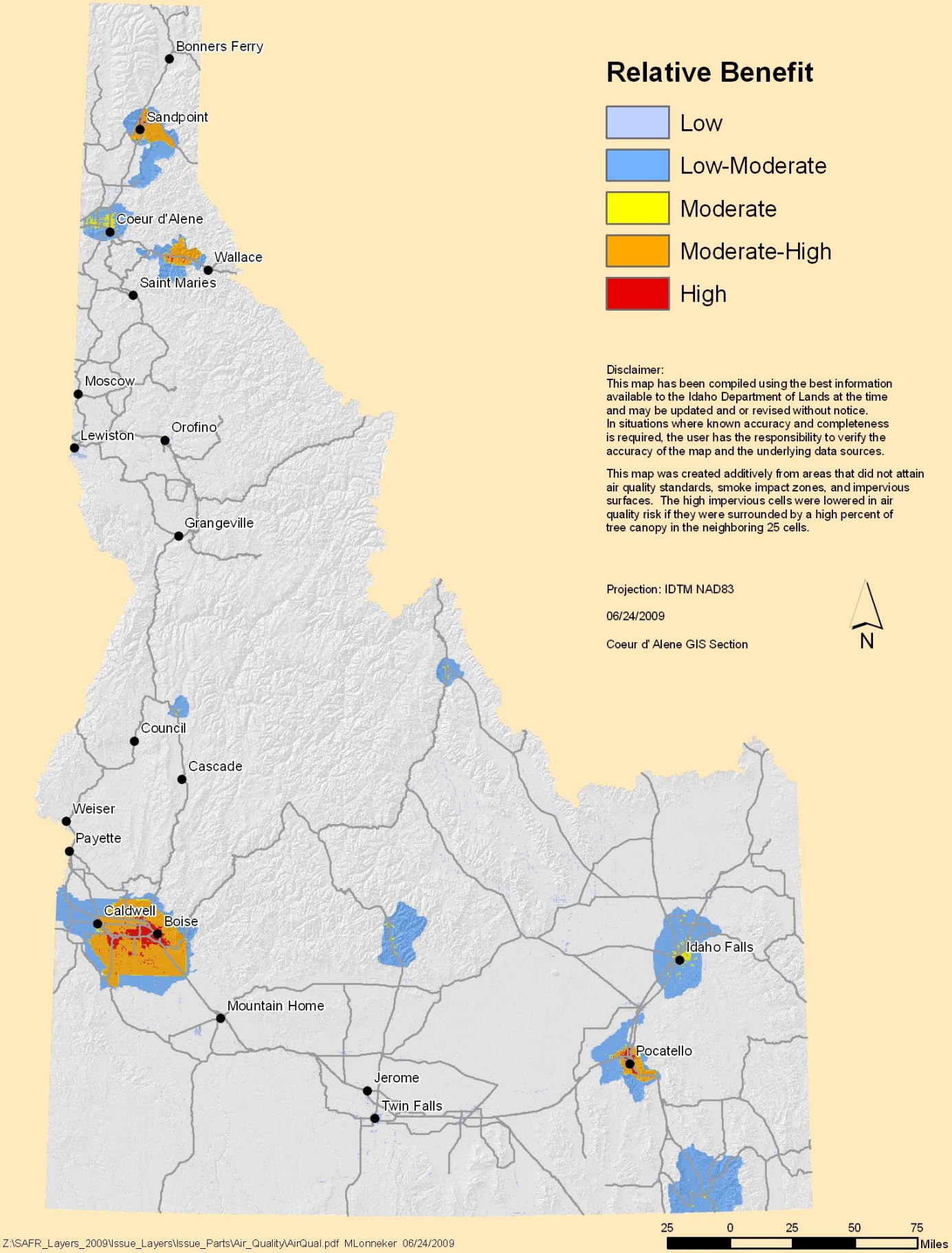
Then, the Impervious surface weight was lowered by the mean percent canopy cover weight.

Final Issue Map: The map is created additively from areas that did not attain air quality standards, are within smoke impact zones, and have a high percentage of impervious surfaces with low percentages of surrounding canopy cover. The additive result was reclassified into 5 classes based natural breaks giving resulting values of 0 – 5.

Data Considered, but not used:

Data on above-ground dry biomass was considered for this issue, as it can be used as a surrogate for carbon sinking. However, the Core Guidance Team determined not to use it for this issue, feeling it was more of an economic issue than one of air quality. As noted above, within this issue, we are trying to locate the areas in which increased canopy could have a relatively high potential for improving poor air quality.

Relative Potential Benefit to Air Quality From Forests and Canopies



Issue: Relative Potential Benefit to Sustainable Forest-Based Markets

—Map (PDF) Relative Potential Benefit to Sustainable Forest-Based Markets (DRAFT)

The intent of this issue is to:

- Identify the forested areas most beneficial to existing and planned mills and biomass utilization facilities.

Discussion: In many areas of the state, communities are economically and culturally dependent upon forestlands. The benefits and products of forestlands include timber, biomass, recreation, hunting/fishing and ecosystem services. Initially, the multi-resource committee and State Assessment of Forest Resources (SAFR) Stakeholder group identified the loss of forest infrastructure (mills, markets, etc.) as a key issue (threat to forests). This threat is greater than simply economics. When markets and mills shut down, incentives to manage forests are significantly diminished, leading to an increase in forest insect and disease problems, fire risk, and a decline in overall forest health.

However, the core team felt that if markets and infrastructure were already gone, it will be very difficult to resurrect them, especially within the changing world economy. Rather, the team felt it better to regard the economic potential of forests as a benefit, and focus on where markets and mills currently exist and additional markets, such as for biomass, are being planned. As communities continue to grow, there is value to considering how this can be accomplished sustainably. That is, producing the food, energy and other resources necessary to support these populations within a set distance surrounding the community.

Drivers, such as the difficulty of Federal lands forest management, were discussed. Various ways to measure this were also discussed (such as amount of litigation in various areas), but the challenge of finding this information and developing datasets to express this is beyond the parameters of this project.

One of the more important datasets to consider is the location of current mills, and existing and planned biomass facilities. Areas that are in close enough proximity to feed these markets will be higher priority for projects. Additionally, forest productivity was also discussed at length. Currently, no dataset exists for productivity across the whole state. The team discussed alternative ways to estimate this. One is to simply use vegetation layer as a surrogate for habitat type. While this doesn't measure potential habitat, it may be all we have to work with.

Data used:

1) **Mill travel Distance**: This layer was developed using known mill locations and the time needed to haul timber to them (provided by IDL's Forest Management Bureau). The mills where divided into two categories based on their raw resource needs and production capabilities, then a cost distance analysis performed using a travel time surface layer. The resulting layer was then stratified into 1, 2, 3, 4, and greater than 4 hour travel time categories. Note that mills outside of Idaho but within the travel buffer distances were also included.
2) **Woody Biomass Facilities Travel Distance:** This layer used point locations for known and proposed biomass facilities and the time needed to deliver woody biomass to them. The facilities where divide into two categories based on their operational times and raw resource needs, then a cost distance analysis performed using a travel time surface layer. The resulting layer was then stratified into 1, 2, 3, 4, and greater than 4 hour travel time categories.
3) **Forested Areas**: The National Land Cover Dataset 2001, produced through a cooperative project conducted by the Multi-Resolution Land Characteristics (MRLC) Consortium, a partnership of federal agencies (www.mrlc.gov). For a detailed definition and discussion on MRLC and the NLCD 2001 products, refer to http://www.mrlc.gov/mrlc2k.asp. Within this dataset are classifications of land cover, including forested areas. For this issue, the following classifications were used: Deciduous Forest, Evergreen Forest, Mixed Forest, Shrub/Scrub, Woody Wetlands, Palustrine Forested Wetlands, Palustrine Scrub/Shrub Wetlands, and Estuarine Forested Wetlands.

Final Issue Map: The composite layer shows a high timber priority close to mill and biomass facilities with diminishing priority as timber is further from mills or biomass facilities. The Mill distance layer and the biomass facilities layer were combined to create a composite layer. Large mills and large biomass facilities were the basis of a time travel classification. Small mills and biomass facilities were used for only 1 hour travel distance indicating their influence is limited and smaller than the large facilities. This layer was then reclassified 5 categories ranging from low to high priority. This data was masked such that only the forested areas described in #3 above are shown.

Data Considered, but not used:

Early on, the intent of this issue was in determining in what areas a lack of (or decline of) mill infrastructure or markets most threaten local economies, overall forest management, forest health, etc. As mentioned in the discussion above, the Core Guidance Team instead chose to focus on beneficial aspects of forest-based markets, identifying the forested areas that support

them. Projects that promote forest health and good forest management within these areas will help develop or maintain supply.

Significant discussion revolved around the desire to incorporate forest productivity data to determine the best areas in which to work once the cost-distance analysis for mill and woody biomass facilities was complete. While this information exists, it is not inclusive of the entire state. The Core Team felt it important to use consistent statewide data to ensure relative prioritization weighed all areas against the same data. The team also considered USDA Natural Resource Conservation Service soils data, but this information is only available county by county, and the effort necessary to combine these was beyond the guidance of using the "best available existing data." The group identified forest productivity as a significant data gap that would be very beneficial to have in the future. The group did consider using an above ground biomass dataset as a surrogate for productivity, but these identified substantially the same areas as the forested classifications of the NLDC 2001 data used in this analysis.

The Core Guidance Team also discussed incorporating other economic benefits from forestlands, such as recreation, hunting and fishing, esthetics, ecosystem services, etc. Ultimately, it was felt that these were covered within the other issues and that this one should focus on timber and woody biomass based market

Relative Benefit for Sustainable Forest-Based Markets in Idaho